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Translated from German

Federal Republic of Germany

File No.: P 3440177.6

[Emblem]
German Patent Office

Date of Application: 2nd November 1984
Date of Disclosure: 15th June 1986

Disclosure of Patent
DE 3440177 A1

Int. Cl. 4:
H 04 N 7/18
H 04 N 5/225
A 61 B ¼
A 61 B 5/07

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Telerecording and Telereproduction Device for Endoscopies in Human and Animal Bodies

A television camera, designed for purposes of endoscopies in the shape of an ellipse, swallowable and transported by the natural peristalsis as advance feed, sends picture point signals to a storage provided outside the body, picture reproduction by means of a visual display unit or picture printing appliances, which retrieve the picture point signals from the storage.

Patent Claims

1. Telerecording and telereproduction device with a television camera insertable into human as well as animal bodies and a reproduction device provided outside the body,

c h a r a c t e r i z e d b y t h e f a c t

that a swallowable continuously moved on television camera for performing a constant photographing procedure, equipped with an illumination attachment, being under the movement influence of the natural peristalsis, is designed to take polydirectional photographs and is equipped with a transmitting device for the radio transmission of television signals corresponding to these photographs, and that the reproduction device is equipped with a receiver for these radio-transmitted television signals.

2. Device according to Claim 1,

c h a r a c t e r i z e d b y t h e f a c t

that the exterior shape of the television camera due to its configuration as an egg-like long elliptical body, encourages its advance movement by means of the natural peristalsis.

3. Device according to Claim 1,

c h a r a c t e r i z e d b y t h e f a c t

that the television camera comprises at least one ferromagnetic element preferably of passive effect, and that its locomotion is achieved by the influence of a magnetic field produced outside the body.

4. Device according to Claim 1,

c h a r a c t e r i z e d b y t h e f a c t

that the television camera has to its entire length, vertically to its longitudinal axis only circular cross-sections on the outside, viz. a design concentric in reference to its longitudinal axis.

5. Device according to Claims 1 to 4,

characterized by the fact

that the television camera carries at least one ferromagnetic effective element, the magnetic longitudinal axis of which is arranged crosswise to the longitudinal axis of the television camera, whereby by rotating the magnetic field produced outside the body, the television camera is rotatable around its longitudinal axis.

6. Device according to Claim 5,

characterized by the fact

that the magnetic field is rotary in all planes of space.

7. Device according to Claim 6,

characterized by the fact

that a detector recognizing the alignment given at any time of the longitudinal axis of the television camera detects the plane of space in respect of the three dimensions of the space, in which each time an additional rotation of the magnetic field is performed in the space.

8. Device according to Claim 7,

characterized by the fact

that the television camera transmits the television signals via a dipole aligned in accordance with the longitudinal axis, and that the detector detects the momentary alignment of the television camera according to the space position of the television signals received from the reproduction device.

9. Device according to Claim 5,

c h a r a c t e r i z e d b y t h e f a c t

that the television camera is equipped with a photographic media focusing on a picture point and transforming light signals into electric signals, which delivers for the picture points spatially arranged in a row a television signal per picture point, viz. a series of television signals.

10. Device according to Claim 9,

c h a r a c t e r i z e d b y t h e f a c t

that the photographic media is connected to an optical lens, which focuses the photographic sensibility each time on a photography point at the surface of the television camera.

11. Device according to Claim 1 or 10,

c h a r a c t e r i z e d b y t h e f a c t

that the television camera is aligned in a light-transparent concentric sleeve and rotatable around its longitudinal axis.

12. Device according to Claim 11,

c h a r a c t e r i z e d b y t h e f a c t

that the sleeve is made of a flexible material and that the television camera is aligned in it floating in a transparent liquid thereby being rotatable.

13. Device according to Claim 11,

c h a r a c t e r i z e d b y t h e f a c t

that the sleeve is made of solid material and that the television camera is rotatable in it by means of a mechanical method of bearing and/or by means of a floating arrangement in a transparent liquid.

14. Device according to Claim 13,

characterized by the fact

that the function of the lens is effectuated or supported by the form-dependent and material-dependent refractive behavior of the liquid and/or the outer sleeve.

15. Device according to Claim 1,

characterized by the fact

that the reproduction device is equipped with a memory, which receives the television signals, in particular picture-point-wise.

16. Device according to Claim 5,

characterized by the fact
that the television camera transmits the television signal per picture point as PCM signal to the reproduction device.

17. Device according to Claim 1,

characterized by the fact

that an inflatable sleeve for enlarging the photography field surrounds the television camera.

18. Device according to Claim 1,

characterized by the fact

that the television camera is equipped with a battery as a supply point.

19. Device according to Claim 2,

characterized by the fact

that the power supply of the television camera is brought about by power radio-transmitted to the television camera in a frequency range differing from the frequency range of the television signals, [power] which the television camera receives via an antenna arranged in parallel to its longitudinal axis.

20. Device according to Claim 9 and 11, in particular also Claim 15,

characterized by the fact

that the outer sleeve bears a marking, which, on rotation of the television camera and overrunning then taking place by its photographic media, produces a marking signal which differs from the other television signals, and that several successive photographic cycles limited by two successive marking signals each, result in a series of television signals, e.g. picture lines, which are successively assigned to one another by means of the marking signals arising in the reproduction device, particularly in its memory, each time at the beginning and/or end of the picture line.

21. Device according to Claim 15,

characterized by the fact

that the television signals, after intermediate storage in the memory, are made visible by a monitor pertaining to the reproduction device.

22. Device according to Claim 9,

characterized by the fact

that the television signals, in particular after intermediate storage, are made visible on paper or similar material by means of a printing device drawing the single picture points.

23. Device according to Claim 9,

characterized by the fact

that the television camera shows a photographic media in the range of its largest circumference – in reference to its circular cross-sections.

24. Device according to Claim 9,

c h a r a c t e r i z e d b y t h e f a c t

that the television camera shows several photographic media, which are lying on its surface in a line running lengthwise to its longitudinal axis.

25. Device according to Claim 1,

c h a r a c t e r i z e d b y t h e f a c t

that the television camera, for taking polydirectional photographs, holds a ring of photographic cells, which are arranged at its surface in a vertical plane in the advance feed direction of the television camera.

26. Device according to Claim 25,

c h a r a c t e r i z e d b y t h e f a c t

that a control circuit activates the photographic cells successively one-by-one in cyclic sequence

27. Device according to Claim 26,

c h a r a c t e r i z e d b y t h e f a c t

that the activation of each photographic cell consists in that each time, for generating a television signal, a media sensitive to light provided in the photographic cell for emitting this signal, will be connected to a circuit device for transmitting same, in particular to an encoder and in particular to a transmitter, and that in particular at the same time an illumination attachment assigned to this photographic cell is switched on, as well.

Telerecording and Telereproduction Device for Endoscopies in Human and Animal Bodies

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The invention relates to a telerecording and telereproduction device with a television camera insertable for an endoscopy into human and animal bodies, in particular into the digestive tract of these, and with a reproduction device provided outside of those.

A device of this type is known already from the USA Patent Specification 2 764 149. The television camera is designed in this case as a probe, which is connected to the reproduction device via a line, which serves for the transmission of the television data.

Practical knowledge shows that many inner organs, e.g. the small intestine, are accessible only in part or with complications and/or discomforts only by means of probes of the type known in the art. Furthermore, it proves to be disadvantageous that by an endoscopy procedure using a probe of the known type, local tying during its course is strictly enforced, whereby, among others, already the duration of an endoscopy procedure is tightly limited in time. Moreover, performing an endoscopy procedure is not only limited in time because of the complications and discomforts connected therewith, but it is also not possible to perform it under any given conditions, e.g. it is not possible to perform it during sleep or physical stress and movement, and not in every position of the body.

The invention has the task, for eliminating the afore mentioned difficulties, to simplify, facilitate and to make the conditions of the endoscopy more independent from outside circumstances. In this connection, it is essential to be able to extend an endoscopy procedure to periods of time of any given length, so that it can be expanded to include inner body parts of any size and length. Thereby it is of particular significance that the advance feed of the television camera shall eliminate discomforts and complications, as far as possible.

The invention solves the task assigned in such a manner that a swallowable continuously moved on television camera for performing a constant photographing procedure, equipped with an illumination attachment, being under the movement influence of the natural peristalsis, is designed to take polydirectional photographs and is equipped with a transmitting device for the radio

transmission of television signals corresponding to these photographs, and that the reproduction device is equipped with a receiver for these radio transmitted television signals.

By the invention, it is rendered possible that for covering larger parts of the inner body, in particular, the digestive tract, by a longer lasting endoscopy procedure, the advance feed of the television camera will be without any discomfort and complications and independent from any outside conditions and open new possibilities for the endoscopy in respect of such conditions, e.g. the condition of the natural sleep. The advance feed can be made by means of the natural peristalsis. According to the invention, it is possible to cover by means of polydirectional photographs the influence of the peristalsis on the advance feed, by the fact that the picture reproduction visualizes compressing or extending distortions, which correspond to an accelerated or respectively, slowed down advance feed.

A radio transmission of physiological signals from the human body to an outside receiver has been provided already in connection with insulin dispensing. However, as in this case it concerns micro-aggregates inserted in a stationary manner into the body, this technique cannot give any idea for solving the problematic issue forming the basis of the invention. This results not only from the fact that such micro-aggregates cannot be brought to the place of action by simply swallowing same; nor does the technique of these micro-aggregates approach the complex of problems of the continuous advance feed of the television camera in dependence to the aim of telerecordings covering larger areas of inner body parts and covering at the same time the natural peristalsis by these photographs.

Further configurations of the invention are stated in the Patent Claims 2 ff.

By the further configuration of the invention according to Patent Claim 2, the possibility of sending on the television camera by means of the natural peristalsis, in particular of the digestive organs, is improved.

The further configuration according to Claim 3 enables to influence the sending on (advance feed) from the outside, viz. to promote or to hinder it or to divert it, e.g. at turns and/or points of convergence or into convex curves.

The further configuration according to Claim 4 creates the possibility of rotating the television camera without applying any considerable force, viz. by means of only slight force application.

A summary of the further configurations dealt with above is combined in Claim 5 with an additional further configuration, according to which the television camera is movable not only or instead of in longitudinal direction from the outside, but also for performing a rotation movement. To be able to carry this out also in elements with twisted shapes of vessels, in particular of the digestive tract, the further configuration according to Claim 6 enables continuous adjusting of the plane of rotation of the magnetic field to the momentary plane of rotation of the television camera (vertical to its longitudinal axis). For this purpose, according to another development of the invention according to Claim 7, a detector is designed, which enables this continuous adjusting. By the further configuration stated in Claim 8, the detector is able to detect the momentary space position and spatial alignment of the television camera by means of the television signals received, in order to continuously align accordingly the plane of rotation of the magnetic field.

According to a further development of the invention according to Claim 9, including some of its further configurations mentioned above, it is achieved that the photographic technique is simplified very much, in particular in connection with the possibility mentioned to carry out a controlled rotation movement. According to this further development, only a photographic media suitable for detecting a single picture point is required, which, in the course of the rotation movement of the television camera, successively detects one after the other the picture points lying in the immediate perimeter of the television camera and causes the emission of the respective television signals for the sequence of these picture points one after the other. As these picture points when moving on in longitudinal direction, are lying on a screw-shaped line, this fact gives rise also to possibilities of conclusions on a non-constant advance feed speed. In this connection, the further configuration according to Claim 10 gives rise to the possibility of increasing both the precision of photography and the light efficiency during photography, which is of advantage to the specific lighting situation.

The further configuration of the invention according to Claim 11 improves the conditions for the rotation ability of the television camera around its longitudinal axis. This is followed by the further configuration according to Claim 12, whereby the television camera

can somewhat adapt itself in its outer shape to the environment. The further configuration according to Claim 13 creates a most favorable condition for the smooth-running rotation ability of the television camera, thereby reducing to a most considerable extent the respective friction and thereby also the force required for the relevant rotation movement.

The further configuration of the invention according to Claim 15 makes it possible to extend an endoscopy procedure to longer periods of time of up to several hours or days, and to evaluate its result in its entirety. The further configuration of the invention according to Claim 16 eliminates the risk of a quantitative falsification of the television signal, at least it reduces this risk considerably.

Supplying the television camera and its illumination attachment with operating voltage according to Claim 18 considerably simplifies this power supply, while this supply according to Claim 19 enables any kind of time extension of the endoscopy procedures.

According to the further configuration of the invention according to Claim 20, it is possible to create in a simple manner a connection among the series of television signals belonging to the successive photography cycles, and the picture lines corresponding to these series can be matched up into a comprehensive television picture. By the further configuration according to Claim 21 it is possible to view as a whole coherently endoscoped body parts. This possibility is offered also by the further configuration according to Claim 22, which, in addition, is able to spare one memory.

The further configuration of the invention according to Claim 23 causes that the photographic procedures always take place at the location where the vessel surrounding the television camera, e.g. the small intestine, has been widened most, viz. is stretched smooth in its surface. It is furthermore caused thereby that the photographic procedures always take place at a location where a possibly existing vessel contents has been pressed away to an optimal extent. The further configuration according to Claim 24 enables, in case of increased advance feed speed, to receive nevertheless a complete television picture in respect of the endoscopy object and its illustration.

In Fig. 1 and Fig. 2 of the drawings, a preferred embodiment of the invention is shown only in those elements which will contribute to

your understanding, it certainly is, however, not limited to same. The specification is restricted at first to a description of Fig. 1.

In the middle part of Fig. 1, there is a transmission device in an egg-like long elliptical housing K shown in cross-section. The housing constitutes an ellipsoid with two equally long axes and with a third axis being longer by approximately one and a half to three times compared to the two axes. The description is approximately a tenfold to thirty-fold enlargement. As apparent, the drawing shows a section illustration, whereby the longer (third) axis and one of the other two axes of the ellipsoid are lying in the drawing plane, the latter in the horizontal plane and the longitudinal axis of the ellipsoid in the vertical plane of the graphic description. Cross-sections to the longitudinal axis, lying vertically to it and vertically to the drawing plane, are circular. However, they could also have an elliptical shape; in this case, the afore mentioned first two semi-axes of the ellipsoid are not equally long.

Housing K, being the housing of the television camera, is situated in an outer light-transparent sleeve (H), which can consist of glass-like rigid material (plastic material) or of a flexible material. The considerably enlarged margin between the housing and the sleeve is filled with a clear transparent liquid, whereby the Housing K and thereby, the entire television camera is rotatable in a smooth running manner around its longitudinal axis, which corresponds to the longitudinal axis of the ellipsoid. Bearings L1 and L2 suggested at the upper and lower end of the housing, could be fitted additionally to eliminate tumbling motion of the television camera and to assure an exact gyroscopic rotation of the television camera when rotating around its longitudinal axis. - Said liquid shows a low adhesion and a low viscosity.

The indicated ellipsoid shape of the housing K of the television camera and of the sleeve H surrounding and pertaining to it as an integral part favors its advance feed by means of the natural peristalsis, e.g. of the small intestine and of the large intestine. When sleeve H is made of flexible material, this will favor the form-fitting adaptation to the inner shape of the vessel surrounding it, on which an endoscopy is to be performed, e.g. of the small and the large intestine. When the sleeve consists of rigid glass-like material. this will favor the smooth running rotation ability and the photographic precision.

The television camera contains a photographic device A with a light-sensitive media A1, e.g. a photodiode or similar, and with an optical

lens A2, which focuses the photographic sensibility of this media to a photographic point (this means an extremely small surface part) at the surface of sleeve H pertaining to the television camera as a fixed component. This means that the entire light sensitivity of Media A1 concentrates on this photographic point. Arranged laterally to it, there is an illumination attachment consisting of two sources of light G1 and G2; these sources of light may consist as light emitting diodes or others, of light generators showing a relatively high efficiency. It is also possible to provide a circular light generator, which is arranged concentrically around the photographic device. The radiation of the light generator or generators is concentrated on the photographic point. The light sensitive media of the photographic device converts the light signals received and detected by means of the lens from the photographic object, on which an endoscopy is to be performed, and this each time from the photographic point on the object, into electric analogue signals, which it transmits to an encoder (C).

The television camera with its sleeve is of such measurements that it can be swallowed. For performing a constant photographic procedure it is continuously moved on. For this purpose, it is influenced by the natural peristalsis. It is designed to take polydirectional photographs, for the purpose of which it is arranged rotatably in its sleeve H in the manner already described. It furthermore contains a transmitting device mentioned already, consisting of the encoder C, a pulse generator T and a transmitter S. The encoder serves for converting the electric analogue signals into PCM signals, which are transmitted to the transmitter S as messages to be sent and are transmitted by it via the dipole D1/D2.

The pulse generator T transmits regularly timing pulses to the encoder. With each timing pulse the television signal existing momentarily and converted each time into a PCM signal, is transmitted to the transmitted S. The photographic points arranged in a row on the photographic object, on which an endoscopy is to be performed, e.g. the inner side of an intestine, are marked one by one by the successive timing pulses. A receiver U of the reproduction device receives the television signals transmitted by the transmitter S in PCM form.

When the television camera is inserted into a vessel, e.g. the small intestine, and slowly advanced in it (advance feed) and when the inner part thereof, i.e. the housing with everything it contains, is rotated in the described manner, the photographic device A with its photographic point, by which an extremely small area is to be

understood, runs along a screw-shaped line within this vessel, that is to say, e.g. of the small intestine, whereby the sections of this line given by each of the successive circulations and consequently juxtaposed (similar to the juxtaposed threads of a screw thread) are at a distance from one another (similar to the distance from one thread to another), which arises from the respective advance feed per photographic cycle covered per revolution of the television camera in the longitudinal direction thereof. Thus, a photographic cycle corresponds to a rotation of the television camera, i.e. a circulation covered by its photographic device at the respective vessel wall. The number of the single photographs per photographic cycle, i.e. per revolution of the television camera, and consequently the number of television signals corresponding to these photographs one by one, which are successively brought for emitting in PCM form, results from the number of revolutions - rotation and thereby the inversely proportional time per circulation, viz. per revolution, and from the timing pulse frequency of the pulse generator T, i.e. from the number of timing pulses per photographic cycle.

The sleeve carries a metal coat reflection effective towards the inner side in the form of a very thin strip, the width of which corresponds to one to two photographic points and which extends from the length of one of its two poles to the other and which lies in a plane in which also its longitudinal axis lies. This strip could also be considerably shorter and be restricted to the area in which the photographic media circulates. As appears from the drawing, this lies in the area of the largest scope of the television camera – in reference to its circular cross-sections lying in vertical position to the longitudinal axis. The photographic media and the illumination attachment optically hit the aforementioned metal coat reflection. It serves as a marking, which, on rotation of the television camera and overrunning then taking place by its photographic media, produces a marking signal, which differs from the other television signals. Several successive photographic cycles limited by two successive marking signals each, result in a series of television signals, e.g. picture lines, which can be successively assigned to one another by means of the marking signals arising in the reproduction device, particularly in a memory pertaining to it, each time at the beginning and/or end of the picture line (picture line beginning and/or end signal).

It is interposed here as a supplement that the optical effect of the lens A2 is activated or supported by the form-dependent and material-dependent refractive behavior of the liquid in the

interspace F and of the outer sleeve. The form of the liquid is determined, of course, by the form of the sleeve enclosing it and by the form of the housing including the lens A2 carried by it. However, the sleeve H can also have in its circular cross-section determined by the circular path of the photographic device A, an additional cylindrical lens, which surrounds the entire sleeve and can consist of an inner or outer arching or recess.

It is furthermore interposed that the sleeve H, when made of a flexible material, can also be inflatable for enlarging the photographic field. The gas required for this can be produced by electrolytic processes or by vaporization and signals required for this can be radio-transmitted in a known manner.

It shall also be added that the television camera can show two or more of the illustrated and described photographic devices or several photographic media in a joint photographic device, which are arranged in a line running along the longitudinal axis and which lies in parallel to the above mentioned strip. Consequently, they lie in the housing in a manner not specified in particular, in the same way as the illustrated photographic device.

The television camera comprises also an electro-magnetic active element W. By producing a magnetic field outside the body on which an endoscopy is to be performed, it is possible to exert a dynamic effect on the television camera. This can be used for influencing the movement of the television camera in its longitudinal direction, viz. for a progressive movement, but also for accelerating or slowing down a movement triggered by the natural peristalsis. Furthermore, it is possible to effectuate navigation of the television camera at diversions or points of convergence or insertion into convex curves in the respective vessel wall.

The main purpose of the element W with ferromagnetic effect is causing the rotation movement of the television camera. To this effect, its magnet longitudinal axis runs transversely to the longitudinal axis of the television camera, whereby by means of a rotation of the magnetic field produced outside the body, the television camera is rotatable around its longitudinal axis. As the vessels, on which an endoscopy is to be performed, e.g. the intestine, can show many bends, which the continuously advancing television camera has to follow, and as the television camera is expected to continue rotating hereby without interruption, the magnetic field is rotatable in all planes of space. Serving this purpose are field coils Y1, Y2 and Y3, which correspond to the three

dimensions of the space, and which may be provided twofold each, and are mounted on the walls of the treatment room, which can be shielded to the outside against interfering fields, e.g. the terrestrial magnetic field. Two coils Y1 may be arranged in parallel to the floor and the ceiling of the treatment room. Two coils Y2 may be assigned to the front and back of the room, and two coils Y3 to the right and the left sidewalls. By means of such or similar coils it is known to be possible to produce a magnetic rotary field in the room, the plane of rotation of which may be chosen at random, viz. may be swiveled at random by charging for this purpose the various coils, single or in combination, with current of varied and continuously changing rates of strength. Assisted by such a rotary field, the rotation of the television camera is caused via its ferromagnetic effective element. The plane of rotation of this field of rotation is constantly adapted to the momentary alignment of the longitudinal axis of the television camera, which is conditioned by the aforementioned bend of the vessel, in which an endoscopy is to be performed, e.g. the intestine, viz. in such a manner that the television camera will always be situated in the plane of rotation of this field of rotation in vertical position.

As already stated, the transmitter S causes emission of the television signals in PCM form via the dipole D1/D2. These signals are received not only by a receiver U of the reproduction device, but also by a detector X. By means of these signals, the detector may determine at any time the momentary spatial alignment of the dipole D1/D2 of the television camera, viz. of its longitudinal axis. For this purpose, it is equipped with three dipoles, which correspond to the three dimensions of the space. The detector X [locating device] continuously detects and notifies data, which relate to the momentary alignment of the television camera, i.e. of its longitudinal axis, via the transmission path x to a joint control device Z. In respect of the three dipoles, it concerns the dipoles x1/x2, x3/x4 and x5/x6. The control device Z charges the field coils Y1, Y2 and Y3, according to these dates, with current of changing rates of strength and direction in such a manner that a plane of rotation is produced thereby in the same plane, in which lies momentarily the plane of rotation of the television camera. The current supply for the field coils ensues via a multiwire line y from the control Z to these field coils.

The television signals received picture-point-wise by the receiver U of the reproduction device by means of its dipoles V1/V2 are transmitted to the storage R, which shows a large number of storage lines apparent from the drawing. Each storage line, which,

in turn, consists of a number of storage elements, serves for the storage of the television signals each pertaining to a photographic cycle, each of which consists of a PCM-word. In the same sequence as these PCM-words are reaching the receiver U, they are successively written word by word into the storage elements by a writing device UR, i.e. always one PCM word into one storage element. And the PCM words pertaining each time to a photographic cycle, will always be written into the storage elements of one storage line each time. Consequently, the number of the photographic cycles completed by the photographic device of the television camera in an endoscopy procedure, equals the number of storage lines written on in this procedure. This number arises from the duration of an endoscopy procedure, which is to be divided by the duration of one photographic cycle each. Beginning and end of one photographic cycle each are designated by the marking signal described already above, assisted by which the line-by-line storage of the PCM words of one photographic cycle each is made possible.

The total result of an endoscopy procedure can be made apparent in a manner known in the art by means of a reading device RP of the storage and by means of a monitor (visual display unit). Furthermore provided is a printing device N, which permits printout of the stored total result of an endoscopy procedure picture-point-by-picture-point in a manner known in the art and also by means of the monitor. This is to say that it prints per PCM word one picture point each and thereby chooses one intensity each for the respective paper blackening according to the sectional picture information received in the respective television signal. This is carried out by the printing device individually each time for one PCM word each, namely one picture point or jointly per photographic cycle, that is to say per picture line. The printing device can image the television signals received by the receiver U also without an intermediate storage in the memory, that is to say, in direct reception by means of the receiver U.

Different advance feed speeds will result in distortions. Due to an increased advance feed speed of the television camera, the successive photographic cycles correspond to a screw-like line with expanding pitch (cf. threads of a screw thread) (and vice-versa), which therefore results in a compressing picture reproduction (and vice-versa). It is possible to recognize thereby an irregular advance feed speed, that is to say, characteristics of the peristalsis. When the advance feed speed is continuously determined in another way, e.g. by means of the detector, it is possible to compensate and

eliminate the distortion effect, should it be undesirable, by means of such additional information.

Finally, an explanation shall be given of the supply of the television camera with operating voltage. For this purpose it is possible to provide a battery B. However, it can also be provided that, in time-related alteration or with different transmission frequencies, on the one hand, PCM words are transmitted from the transmitter S to the receiver U, and on the other hand, high-frequency signals are transmitted as energy carriers from the detector which, in this case, is additionally configured as a high-frequency transmitter (and which, if necessary, should also work in time-related alternate operation), to a photographic device E, which is to be configured as a filter penetrable only by these high-frequency signals, from which the energy received is conveyed to the battery which, in this case, serves as a buffer.

Another variant of an embodiment of the invention is illustrated in Fig. 2 of the drawings. In this variant, there is no need for the sleeve and the arrangements according to Fig. 1 for causing the television camera to rotate by means of the rotary field. In the range of the largest circumference of the television camera, in reference to the cross-section plane lying in vertical position to its longitudinal axis, it shows to its total circumference (eventually to part of its circumference only) a large number of light-sensitive media similar to that described in Fig. 1 (A1), viz. something like a ring of such media. Assigned to these media are individually light producing elements, viz. light producers, similar to the arrangement described in Fig. 1. The illustration according to Fig. 2 shows a cut placed in this range in vertical position to its longitudinal axis; housing K1 may show a similar configuration as housing K in Fig. 1. Such a light-sensitive media is combined each time with a light producer to form a photographic cell. In the range of the largest circumference, a ring of such photographic cells AG1 to AGn (or only AG1 to AGm) surrounds the television camera according to Fig. 2. Its housing may also be clear as glass, light-transparent, at least in front of each of the photographic cells AG1 to AGn.

The television camera according to Fig. 2 shows a control circuit Q, which serves for activating one-by-one the photographic cells AG1 to AGn for dealing with the photographic cycles. Each of the photographic cells is connectable to an encoder similar to the one described by Fig. 1. For this purpose, a central bus line, which is not indicated, is provided, which is successively led to all photographic cells and to this encoder. The activation of each

photographic cell, for which control lines q1 to qn are provided, consists in that its illumination attachment (light producer) is switched on and that its light-sensitive media is connected to the encoder via the bus line. It is also possible, when activating a photographic cell, to activate in addition the light producers of photographic cells adjacent to it.

By means of the control circuit Q, dealing with the photographic cycles is effected, which are comparable in their results to the photographic cycles described in Fig. 1. Thereby, each of the photographic cells supplies, each time when being activated one television signal each; consequently, the photographic cells arranged in a circular (endless) row, supply series of television signals in the cyclic rotating control circuit processes in a similar manner as in the arrangement according to Fig. 1. One of the photographic cells may supply a marking signal, which clearly differs from all other television signals, whereby beginning and end of each of the photographic cycles is signalized and marked. Encoding, transmission and evaluation of the television signals and the operational voltage feeding may be realized in a manner similar to the arrangement according to Fig. 1.

The embodiment variant of the invention according to Fig. 2 makes the constant rotation procedures of the television camera superfluous, as they are provided in the arrangement according to Fig. 1, and in connection therewith, the outer sleeve H. The arrangement according to Fig. 2 as well as the arrangement according to Fig. 1, may be equipped with a ferromagnetic effective element W. And this for the reason that when the television camera according to Fig. 2 is configured to take polydirectional photographs in the perimeter of a semicircle (e.g. photographic cells are provided only from AG1 to AGm), it will then be possible that by means of this element, the television camera will be turned around under the influence of an outside magnetic field, in order to align its semi-ring of photographic cells AG1 to AGm to the desired section of the vessel on which an endoscope is to be performed. A television camera in the configuration arising from Fig. 2, makes it possible to do without detecting measures and devices and to simplify considerably the means for the production of the outside magnetic field, since there is no longer any need for the production of a field of rotation in all the different planes of space. The nonrecurring rotation of the television camera can be performed before starting a photograph. – The arrangement according to Fig. 2 creates the further possibility to provide a portable receiver and to

combine it together with an amplifier and/or a converter and a transmitter, which will then transmit the television signals to a reproduction device similar to the one shown in Fig. 1. Thereby the possibility would be given that the carrier of such an endoscopy television camera could walk freely within a limited perimeter.